# YARN TEXTURIZER

## Field of the Invention

**[0001]** The present invention relates to a yarn texturizer and a multiple port yarn texturizer having an improved insert construction.

## Brief Description of Related Art

**[0002]** In the prior art, yarn texturizers generally have inserts which fit within housings in a base. The inserts are comprised of an elongated member having a divergent head which terminates within the housing as shown in Figure 1. Air passes around the elongated body. As the air passes by a twist member, rotation is imparted to the air. The spinning air continues about the divergent end where it reverses course and flows into a bore disposed within a convergent section at the distal end of the insert. The housing extends past and over the distal end of the insert to assist in directing the air flow.

**[0003]** Yarn is normally fed through a hollow adjusting screw located above the bore in the insert. The screw extends through the prior art housing. Depending upon the extent to which the screw is inserted or backed out relative to the bore in the insert, the amount of vacuum experienced at the inlet to the bore which is adjusted. One problem with the prior art designs is that operators can unknowingly affect the performance of the yarn set or crimp by moving the screw relative to the bore. Some operators might prefer the screws backed out while other operators may prefer them as tight as possible. While this may not directly affect the operator, it produces a different set in the yarn which can be visible when tufted into a carpet to affect the runability of the downstream processes. Furthermore, the screws can become loose or galled over time thereby affecting the performance of the prior art design. Additionally, since

texturizers typically have multiple stations, producing the exact same crimp in the yarn through the various stations may be difficult when each station is manually adjustable.

**[0004]** A second prior art design shown in Figure 2 has a similar insert construction but the screw or conical needle as it is often called is connected to a plunger which may be moved by air pressure up and down to assist in threading yarn through the insert and conical needle. Specifically, when the plunger is pushed towards an up position, shown in phantom, the amount of suction into the bore of the insert is significantly less which makes it much easier for the operator to thread up the texturizer station. Once threaded, the plunger may be returned to an operational position. Once again, the moving nature of the conical needle relative to the bore of the insert provides parts which wear over time and are subject to failure. Furthermore, this type of design is normally provided with adjustment parts to allow for the adjustment of the limits of travel of the plunger so that an operator can once again drastically affect the performance of the yarn as it is texturized by the texturizer of the prior art in Figure 2.

**[0005]** In both prior art designs air passes around the diverging distal end of the insert from all 360 degrees and then is directed through the bore as the insert narrows from the end to the entrance of the bore as shown. This 360 degree of air coverage provides somewhat of a donut that then narrows about the yarn as shown in Figure 1 to then pull it through the bore while also simultaneously performing the crimping and/or setting of the yarn as it passes through the texturizer. While the donut technique obviously works as it has been utilized in the prior art, it is not believed to be the optimum way to direct air through a texturizer to provide the most desirable and consistent crimp to the yarn.

## Summary of the Invention

**[0006]** Accordingly, an object of the invention is to provide an improved texturizer that does not rely on an adjustment of individual stations or allow operators the opportunity to get stations out of adjustment.

**[0007]** Another object of the present invention is to remove threaded components which could otherwise gall, seize, or be misadjusted.

**[0008]** It is another object of the present invention to provide more consistent running of the product through a texturizer.

**[0009]** It is another object of the present invention to provide better overall runability and increase the efficiency of air-to-yarn concentration.

**[00010]** It is another object of the present invention to reduce the potential maintenance associated with the texturizer.

**[00011]** Accordingly, a texturizer of the presently preferred embodiment of the present invention has at least one station, each station having a housing surrounding an insert. Unlike prior art inserts which typically have a significantly smaller cross section along a majority of the length until the distal end of the insert, the preferred embodiment of the present invention employs an insert having a collar with an outer surface which substantially corresponds with the internal surface of the housing except for a plurality of slots which extend along the inner surface of the housing to provide channels to direct air flow.

**[00012]** Specifically air flows through the slots towards a distal end of the insert. Prior to reaching the distal end of the insert, proximally angled inwardly directed passages direct air from the slots towards the insert bore which extends through the center of the insert along a yarn travel axis. These inwardly directed passages are in communication with the slots so that air proceeds

distally towards the distal end of the insert along the slots and then reverses direction towards the proximal end or discharge end of the texturizer insert through the passages. The inwardly directed passages preferably have axes which intersect along the yarn travel axis of the bore at an impingement point. By providing direct impingement at a single point, better overall runability is achieved and more efficient air-to-yarn concentrations achieved. More consistent running of the product is also achieved and less maintenance issues are encountered over the life of the texturizer. Although the preferred embodiment envisions opposing slots symmetrically arranged about the yarn or travel axis, other embodiments then may have three or more slots and may meet at more than one impingement point within the bore axis.

**Brief Description of the Drawings**

**[00013]** The particular features and advantages of the invention as well as other objects will become apparent from the following description taken in connection with the accompanying drawings in which:

Figure 1 shows a cross section portion of a first prior art texturizer port showing an insert located proximately from a hollow conical needle located at the distal end of a housing;

Figure 2 is a second prior art texturizer cross section portion having a conical needle connected to a plunger moveable with air pressure to provide for easy threading of the insert with yarn;

Figure 3 is a top perspective view of an assembled texturizer according to the presently preferred embodiment of the present invention;

Figure 4 is a cross-sectional view taken along the line A-A of Figure 3;

Figure 5 is a cross-sectional view taken along the line B-B of Figure 3;

Figure 6 is one of the plurality of housings shown in Figures 3-5;

Figure 7 is a side elevational view of an insert taken from the texturizer of Figure 3; and

Figure 8 is a side plan view of the insert of Figure 7 with internal parts shown in phantom.

**Detailed Description of the Drawings**

**[00014]** In prior art texturizer designs shown in Figures 1 and Figures 2, pressurized air is directed into a housing **10** from a manifold connected through a base (not shown). As the air proceeded distally towards top end **12** from internal to the housing it passes through vanes **14** which are machined into an insert **16** to impart rotational forces to the pressurized air illustrated as arrows **18.** The swirling air is then be directed about the distal end **20** of the insert **16** which diverges at its distal end along its external surface and then narrows towards a bore **20** as yarn **24** proceeds from the distal end **20** toward the proximal end to the insert **16.** As the arrows **18** (representing air flow) proceed around the distal end **20,** a donut of air is effectively formed which constricts about the yarn **24** to pull it through the bore **22** as well as impart crimp the yarn **24** and thus texturize the yarn **24** as it proceeds through the texturizer.

**[00015]** In the design of Figure 1, an adjustment screw **26** having a bore **28** therethrough is utilized to adjust the amount of vacuum experienced by the yarn **24** as it proceeds into the bore **22** of the insert **16.** Operators are prone to haphazardly adjust the adjusting screw **26** (i.e., some would back it all the way out, some would crank it all the way in). Unfortunately, moving the screw affects the crimp of the yarn **24** which can be observed in finished tufted carpet product. Furthermore, the ability to move the screw relative to the insert can result in galling of the housing or screw threads. Finally, the moving of the threads **30** relative to the housing **10** can become loose over time thereby affecting the quality and/or consistency of the texturized yarn product.

**[00016]** Figure 2 shows a second prior art design which includes a moveable conical needle **50** relative to insert **52**. Air ports **54,56** allow the plunger **58** to be moved to the up position shown in phantom in Figure 2 which moves the conical needle **50** distally from the insert **52**. This has been found to be helpful in order to reduce the vacuum quickly to allow yarn to be threaded into the insert. Internal screw adjustments are normally provided to allow for the adjustment of the spacing of the needle **50** from the insert. This design provides further complicated structure and provides more moving parts which could fail over time. Once again, this product design relies upon a ring or donut for the air to be directed around the distal end **60** of the insert **52** towards the bore **62** to texturize yarn.

**[00017]** In both prior art designs, the inserts **16,52** have expanding cross sectional surface area across the exterior surface at the distal ends while having narrowing surface areas across internal surfaces proceeding proximally from the distal ends **20,60** toward the insert bores.

**[00018]** Figure 3 illustrates a presently preferred embodiment of the present invention. Texturizers **100** can vary in the number of ports and in the arrangement of air. The specific configuration of air provided from an air supply to the individual housings **102** illustrated in Figure 3 is one example. This embodiment of a texturizer **100** is believed to provide sufficient detail to one of ordinary skill in the art to show how other embodiments would also operate.

**[00019]** Treated air is provided through inlets **104,106** into texturizer base **108.** Flange **110** is useful in connecting the inlets **104,106** to their respective air supplies at a manufacturing facility having the necessary equipment. Bolt holes **112** receive bolts therethrough to connect to the necessary air supply equipment. Air enters the inlets **104,106** as shown in Figure 4.

**[00020]** As air proceeds into the inlets **104,106** it is preferably directed past thermocouple ports **114,116** which house thermocouples or other temperature sensors utilized to measure the

temperature of the air supply provided into inlets **104,106**. In the texturizing yarn it is normally important to maintain the inlet air supply and desired temperature or temperature range since air temperature and pressure both can drastically affect the crimp of the yarn as it leaves the texturizer **100**.

**[00021]** Although many texturizer embodiments provide a single inlet **104** or **106** for a single station, in this embodiment a single inlet **104** or **106** provides each of two stations respectively. Specifically, first inlet **104** provides air to first and second stations **118,120**, while second inlet **102** provides air into third and fourth stations **122,124**. Plugs **126,128** are useful in directing the flow of air to stations internal to the base **108** and simplifying machining processes.

**[00022]** In reference to Figure 5 showing texturizer **100**, differences between the presently preferred embodiment of the present invention and the prior art begin to thoroughly distinguish themselves. Since Figure 5 is a cross section taken along the center line only the first and second stations **118,120** are illustrated since the third and fourth stations **122,124** are obscured from view in this cutaway view. As the air proceeds from the respective stations it enters ducts **126** shown in Figure 6. These ducts **126** have been machined into the housing **102** and provided for air communication to flow from the inlets **104,106** through the respective stations **118,120,122,124** and then through the ducts **126** internal to the housings **102**.

**[00023]** As air passes through the ducts **126** it surrounds the receivers **128** of the respective inserts **136** shown in Figures 7 and 8. While the air may surround the receivers **128** 360 degrees as is done in the prior art, it is channeled through slots **130** disposed in collar **132** so that air can proceed from the receiver **128** through the slots **130** towards the distal end **134** of the respective insert **136**. Instead of reaching the distal end **134** as is done in the prior art while diverging, the air flow is maintained through the respective slots **130** until reaching respective passages **138**.

**[00024]** The passages **138** preferably proceed from a distal exterior portion of the collar **132** of the insert **136** in the slot **130** towards the proximal end **140.** Although the passage **138** is illustrated as being directed about 20 degrees relative to yarn travel axis **142** other relationships between about 10 to about 80 degrees could be utilized. Furthermore, the passages **130,132** are preferably symmetrical as illustrated. As yarn is run along the yarn travel axis **142**, it is drawn by the pressure differential caused by the air flow through the passage **138** towards impingement point **144.** The force of the air through the passages **138** contacting the yarn (shown in Figure 5 in one of the four inserts) causes the yarn to crimp primarily due to the impingement force at the single impingement point **144**.

**[00025]** Instead of providing a 360 degree circle or donut of air about the yarn, the direction of air through slots and passages **130,138** to impingement or pinch point **144**, more efficient air-to-yarn concentration is achieved resulting in more consistent running of product. Furthermore, a lack of moving parts between the distal end **146** and the housing provides an impingement point **144** in which no threaded components can gall, seize, or otherwise be subject to undesirable adjustment by operators. Since there is no operator adjustment provided by the texturizer **100** design, better overall runability is achieved (i.e., as long as the same pressure and temperature are provided through the inlets **104,106** and provided with the same yarn inserted at the distal ends **134** of the inserts **136**, a more consistent and high quality output will be discharged from the proximal ends **140** of the inserts **136**.) In fact, runability has been found to increase from about 95% in the prior art texturizers to slightly over 98% through the use of the preferred embodiment.

**[00026]** In the prior art, air would be disposed around a receiver and would be similarly spaced apart from the internal surface of the housing. The insert would remain spaced apart from the

housing interior surface until encountering the diverging end of the insert and the distal end of the housing.

**[00027]** In the design in accordance with the presently preferred embodiment, the collar **132** substantially corresponds with the internal surface of the housing **146** except for the slots **130** which allow air to be communicated from the receiver **128** through the slots **130** to the passages **138**. The passages **138** are spaced from the distal end **134** of the insert **136**. An O-ring **150** as shown in Figure 5 is installed about groove **152** shown in Figure 8 to provide an airtight seal. Caps **154** retain the inserts **136** in the housings **102.** The housings are preferably silver soldered or otherwise attached to the base **108** to the form air tight connections therewith.

**[00028]** Although two slots **130** which oppose the yarn travel axis **142** and extend radially therefrom are illustrated, it is alternatively possible that three or more circumferentially or radially equally spaced passages **138** and slots **130** can be employed. Furthermore these airways may also be symmetrical about the yarn travel axis **142** especially when there are an even number of passages provided. In accordance with this embodiment, the collar **132** separates the slots **130** from one another. In Figure 5, the yarn **156** is shown inserted into the distal end **134** at the insert **136** as it proceeds to the impingement point **144** and is crimped to the desired state and proceeds on out of the proximal end **140.**

**[00029]** A ceramic insert **158** is helpful in preventing the yarn **136** from inadvertently being cut as it passes through the distal end **134.**

**[00030]** As shown in Figure 7, a shank base **160** is located below the receiver **128.** The shank base **160** preferably has an exterior surface **162** which substantially corresponds with the interior surface **146** of the housing **102** so that it effectively forms an air tight seal with the shoulder **164** contacting bottom **166** of the housing **102.** The cap **154** is preferably equipped with internal